UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/767,136	01/28/2004	Joong-Hyun Baek	9903-085	4303

20575 7590 08/23/2005

MARGER JOHNSON & MCCOLLOM, P.C.
210 SW MORRISON STREET, SUITE 400
PORTLAND, OR 97204

EXAMINER	
DOLAN, JENNIFER M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 08/23/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/767,136	BAEK ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-4* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-4* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *28 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 10/232,344.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *1/28/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-4 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, line 3, recites the limitation of "the chip." There is insufficient antecedent basis for this limitation in the claims. For the purpose of examination, it is assumed that the beginning of line 2 reads as follows: "providing a substrate having a chip mounted thereon, the substrate having an upper surface ..."

Regarding claim 1, line 8, it is further unclear as to what is meant by "forming a solder preform," since the step of forming the layer would by definition make the solder layer not be a preformed layer. For the purpose of examination, it is assumed that the method step includes applying a solder layer that will subsequently be reflowed.

Regarding claim 3, the claim recites the limitation of "the semiconductor package of any of claim 1." It is unclear what the Applicant intends to claim by this, since claim 1 refers to a method and not a package. For the purpose of examination, it is assumed that the beginning of claim 3 reads as follows: "The method of claim 1, wherein..."

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1 –3 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,437,240 to Smith (hereafter Smith '240) in view of U.S. Patent No. 5,747,102 to Smith et al (hereafter Smith '102).

Regarding claim 1, Smith '240 discloses a method for forming a semiconductor package (figures 24-25) comprising: providing a substrate (1412, 1512) having a chip (1424, 1524b) mounted thereon, the substrate having an upper surface and a lower surface opposite the upper surface, the chip being connected to the upper surface of the substrate (see figures 24-25); forming a plurality of void pads (column 28, lines 17-27; void pads include areas not covered by the wettable barrier metal spots in one embodiment or by the non-wettable solder mask in another embodiment) on the back surface of the chip and formed of a material non-wettable by solder (column 28, lines 12-17); applying a flux on the back surface of the chip (column 28, lines 1-5; column 10, lines 45-52); forming a solder layer on the flux (column 10, lines 35-52; column 28, lines 1-12); and reflowing the solder to form voids aligned with the void pads (columns 28-29; column 30, line 55 – column 31, line 21).

Smith '240 is silent as to the specific composition of the flux material.

Smith '102 teaches that solder fluxes commonly include solvents (column 2, lines 37-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the flux of Smith '240 includes a solvent, as taught by Smith '102. The rationale is as follows: A person having ordinary skill in the art would have been motivated to include a solvent in the flux, because Smith '102 shows that such an inclusion is common and well known in the art of solder fluxes, and that a solvent is needed to act as the liquid carrier for the flux ingredients (see Smith '102; column 2, lines 37-47).

Regarding claim 2, Smith '240 teaches putting a lid (1442, 1542) on the solder layer.

Regarding claim 3, Smith '240 shows that the voids (areas between 1450 elements or 1550 elements) are formed equally spaced (figures 24-25). Smith further shows that the solder material with voids is used for thermal dissipation and stress management (see columns 28-30). Smith does not, however, explicitly teach that the voids are formed along a perimeter of the chip at uniform distances.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the voids of Smith '240 as modified by Smith '102 are equally spaced across the entire chip, and hence, along the perimeter of the chip. The rationale is as follows: A person having ordinary skill in the art would have been motivated to specify that the voids are equally spaced, because Smith '240 shows a evenly spaced void distribution across the chip (figures 24-25), and a uniform void distribution will lead to uniform thermal conduction as well as uniform stress relief across the chip, as is appreciated by a person skilled in the art.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Smith '240 in view of Smith '102 as applied to claim 1 above, and further in view of U.S. Patent No. 6,409,073 to Kaskoun et al.

Smith '240 discloses that a barrier metal layer (1452, 1552) is formed on the back surface of the chip to expose the void pads (column 28, lines 12-40) and that the barrier layer must be wettable to solder, but fails to specify the material composition of the barrier layer.

Kaskoun teaches that a solder-receiving bump is preferably formed of copper with a nickel-gold layer plated on the outer surface (column 5, lines 30-45; column 6, lines 13-32).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to specify that the barrier metal layer of Smith '240 as modified by Smith '102 is made of copper with Ni/Au plated thereon, as suggested by Kaskoun. The rationale is as follows: A person having ordinary skill in the art would have been motivated to use a stack of copper and Ni/Au for the solder-receiving surfaces, because copper has both high electrical and thermal conductivity, as is appreciated in the art, such that the usage of copper would advantageously aid in conducting heat to the lid portion of Smith '240, and because a Ni/Au layer disposed on the copper layer will act as a highly solder-wettable surface that is further protected from oxidation (see Kaskoun, column 5, lines 30-45; column 6, lines 13-32).

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. U.S. Patent No. 6,245,186 to Alcoe et al. discloses a structure using solder balls with voids therebetween as a thermal interface material between a chip and a heatsink/lid portion.

b. U.S. Patent No. 6,396,700 to Chu et al. discloses a patterned solder layer used as a thermal interface layer between a chip and a heat spreader.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd

CARL WHITEHEAD, JR
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800